UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 5
77 WEST JACKSON BOULEVARD
CHICAGO, IL 60604-3590

REPLY TO THE ATTENTION OF:
WU-16J

PROPOSAL TO REISSUE AN EXEMPTION TO ARCELORMITTAL - HENNEPIN WORKS FOR THE CONTINUED INJECTION OF HAZARDOUS WASTE SUBJECT TO THE LAND DISPOSAL RESTRICTIONS OF THE HAZARDOUS AND SOLID WASTE AMENDMENTS OF 1984

Action: Notice of Intent to Grant an Exemption for the Injection of Certain Hazardous Wastes to ArcelorMittal Hennepin, Inc. for one Injection Well located at 10726 Steel Drive, Hennepin, Illinois.

Summary: The United States Environmental Protection Agency (EPA), Region 5, Chicago office, proposes (through this notice) to grant an exemption from the ban on disposal of hazardous wastes (land ban) through an injection well to ArcelorMittal Hennepin, Inc. (Hennepin Works) of Hennepin, Illinois. If the exemption is granted, Hennepin Works may continue to inject Resource Conservation and Recovery Act (RCRA, codified at 42 USC §§ 6901-6992k) regulated hazardous wastes, defined at Title 40 of the Code of Federal Regulations (40 CFR) Part 261 and designated by waste code K062, through waste disposal well WPL-1.

On March 6, 2007, Hennepin Works submitted a petition to the EPA seeking an exemption from the land ban. The petition is based on a showing under 40 CFR § 148.20(a)(1)(i) that any fluids injected will not migrate vertically out of the injection zone or laterally to a point of discharge or interface with an underground source of drinking water (USDW) within 10,000 years. The EPA has conducted a comprehensive review of the petition, its revisions, and other materials submitted and has determined that the petition submitted by Hennepin Works, as revised on February 4, 2008, meets the requirements of 40 CFR Part 148, Subpart C.

Supplementary Information:

I. Background

A. Regulatory Requirements – Section 3004 of the RCRA prohibits the land disposal of untreated hazardous waste. RCRA specifically defines land disposal to include any placement of hazardous waste into an injection well (RCRA Section 3004(k)). Under 40 CFR § 148.20, any person seeking an exemption from that prohibition must submit a petition demonstrating that, to a reasonable degree of certainty, there will be no migration of hazardous constituents from the injection zone for as long as the waste remains hazardous. These petitions, commonly referred to as "no-migration" petitions, must meet the regulatory standards promulgated in 40 CFR Part 148, Subpart C.

The demonstration of no-migration requires a showing that either 1) injected fluids will not

migrate upwards out of the injection zone or laterally to a point of contact with a USDW, or 2) before such migration occurs, the injected fluids will no longer be hazardous. The Underground Injection Control (UIC) regulations specify the time frame for which these predictions must be demonstrated as 10,000 years.

B. Facility Information – The Hennepin Works injection well is located at 10726 Steel Drive in the City of Hennepin in Putnam County, Illinois. The Illinois Environmental Protection Agency (IL EPA) previously issued a permit to the Hennepin Works facility to dispose of liquid wastes by deep well injection. The operator has constructed one well. The proposed exemption is based on a long term average injection rate for the well of 153 gallons per minute (gpm) averaged over one-month periods, for a total of 6,705,990 gallons per month. The long term average rate limit is used to bound the area of the waste plume so that the plume will be no larger than the area estimated in the petition. The rate at which Hennepin Works may inject is also limited by the maximum allowable surface injection pressure.

C. Today's Proposed Decision – On March 6, 2007, Hennepin Works submitted a petition for exemption from the land disposal restrictions of hazardous waste injection under the Hazardous and Solid Waste Amendments of RCRA. EPA reviewed this submission and requested additional information. Based on the additional supporting documents received on February 4, July 17, and August 13, 2008, EPA has determined that Hennepin Works has demonstrated, to a reasonable degree of certainty, that any fluids injected will not migrate vertically out of the injection zone or laterally to a point of discharge or interface with an USDW within 10,000 years.

II. Basis for Determination

A. Waste Identification and Analysis (40 CFR § 148.22(a)) – Hennepin Works has petitioned the EPA, Region 5, to grant an exemption to allow injection of wastes from the processes of steel pickling and galvanizing bearing the RCRA waste code K062. Under the proposed exemption, Hennepin Works can inject only this waste. A waste analysis was performed and submitted as supplementary information to the no-migration petition. This analysis was conducted in accordance with the quality assurance standards required by 40 CFR § 148.21(a), and adequately describes the characteristics of the waste.

B. Mechanical Integrity Test Information (40 CFR § 148.20(a)(2)(iv)) – In order to confirm that all injected fluids are entering the approved injection interval and not channeling up the well bore out of the injection zone, 40 CFR § 148.20(a)(2)(iv) requires the petitioner to submit the results of a successful annulus pressure test and a radioactive tracer survey. These tests demonstrate the mechanical integrity of a well's long string casing, injection tubing, annular seal, and bottom hole cement. This well at Hennepin Works passed these tests successfully in October of 2008.

C. Local and Regional Geology (40 CFR § 148.21(b)) – Class I hazardous waste injection wells must be located in areas that are geologically suitable. Hennepin Works provided site-specific geologic, hydrologic, and geochemical information, including descriptions of the depositional environments of the formations, well logs, cross-sections, well and formation tests,

and geologic maps, to support the demonstration of no-migration. EPA's evaluation of the structural and stratigraphic geology of the local and regional area determined that the Hennepin Works facility is located at a geologically suitable site.

1. Identification of Underground Sources of Drinking Water – The lowermost USDW at the site is the Franconia Sandstone, with a base at 2510 feet (Figure 1)[1] . There are approximately 599 feet of separation between the lowermost USDW and the Injection Interval, where the waste is emplaced. This separation zone is composed of dolomite, sandy shale, and shale interbedded with siltstone and sandstone, which are predominantly characterized by low permeability at this location, as well as overlying sandstone units.

2. Injection Zone – The Injection Zone must have sufficient permeability, porosity, thickness, and extent to contain the injected fluids. The injection zone for the Hennepin Works facility is composed of the Lower Eau Claire Formation and Mt. Simon Sandstone, between 2902 and 4800 feet below the surface. The Injection Zone is composed of the Injection Interval, into which the waste is placed, and the overlying Arrestment Interval (Figure 1). Waste is directly emplaced at depths between 3109 and 4800 feet into the Mt. Simon Sandstone, which consists predominantly of very fine- to coarse-grained sandstone. It can accept the volume of waste proposed by Hennepin Works because it has high permeability and porosity.

The Arrestment Interval, between 2902 and 3109 feet, is composed of the Lower Eau Claire Formation (Lombard and Elmhurst members). This is a continuous rock formation of low vertical permeability, which is free of transecting, transmissive faults or fractures over an area sufficient to prevent the upward movement of waste.

3. Confining Zone – (40 CFR § 146.62) – The regulations which specify the minimum criteria for siting Class I hazardous waste injection wells require that the Injection Zone must be overlain by at least one additional formation which can confine the injected fluids. This formation is known as the Confining Zone, and it must be (1) laterally continuous, (2) free of transecting, transmissive faults or fractures over an area sufficient to prevent fluid movement, and (3) of sufficient thickness and lithologic and stress characteristics to prevent vertical propagation of fractures. The Confining Zone at the Hennepin Works facility is the upper Eau Claire Formation (Proviso Member), which is found between 2705 and 2902 feet (Figure 1). It is a 197-foot thick, laterally extensive shale interval interspersed with sand and silt layers. It has no known transmissive faults or fractures within the Area of Review (AOR), and will resist vertical migration because of its low natural permeability.

The confining zone must be separated from the lowermost USDW by at least one sequence of permeable and less permeable strata that will provide added layers of protection by either allowing pressure bleed-off (high permeability units), or by providing additional confinement (low permeability units). The "bleed-off" unit is the Ironton-Galesville Sandstone found between 2535 and 2705 feet, which is comprised of dolomitic sandstone having high permeability. It is capable of accepting significant amounts of fluid without developing excessive hydrostatic pressure. Overlying the Ironton-Galesville Sandstone is the Lower

[1] All depths in this document are referenced from a 14-foot Kelly bushing (KB) unless labeled as referenced from ground surface.

Franconia Shale, found between 2510 and 2535 feet. It has low permeability and acts as an effective confining layer between the overlying and underlying aquifers. These rock formations are laterally continuous for hundreds of square miles and provide the required additional layers of protection.

4. Absence of Known Transmissive Faults (40 CFR § 148.20(b)) – There are no known transmissive faults in the Lower Eau Claire Formation, the stratum within the injection zone that will confine fluid movement, or in the overlying upper Eau Claire Formation. In addition, hydrostatic pressure measurements of the Galesville Formation in the Galesville Monitoring Well show no response to injection into the WPL-1 well, confirming the absence of transmissive faults or fractures in the Arrestment Interval and the Confining Zone.

5. Seismicity – Illinois is an area of very low seismic risk. Midwestern earthquakes are infrequent, generally of low magnitude, and have epicenters deep within the Precambrian granitic rocks far below the injection reservoir. There is virtually no possibility of damage to the Hennepin Works well or leakage of waste from the injection zone as a result of seismic activity.

6. Geochemical Conditions (40 CFR § 148.21(b)(5)) – The petitioner must adequately characterize the injection and confining zone fluids and rock types to determine the waste stream's compatibility with these zones. The injection zone is composed mainly of permeable sandstone and dolomite, with some sections of shale and arkosic sandstone, while the confining zone is composed of a thick, laterally extensive shale interval interspersed with sand and silt layers. These rock types are generally resistant to alteration by fluids. Core flow analyses of Mt. Simon core samples from the WPL-1 well showed that the Mt. Simon has consistent permeability over a wide range of salinity. Tests of Mt. Simon core samples, including upper Mt. Simon shales, taken from a different location show that the Mt. Simon undergoes no changes in permeability or porosity that would reduce its ability to contain the waste. The formation brine in the injection zone has a neutral pH. The injected fluid is compatible with these conditions.

D. Wells in Area of Review - Under 40 CFR § 146.63, the AOR of Class I hazardous waste wells is a two-mile radius around the well bore, or a larger area specified by EPA based on the calculated cone of influence of the well. The cone of influence is the area within which pressure in the injection interval can raise a column of formation fluid or injected fluid sufficiently to cause contamination of a USDW. Using extremely conservative assumptions, the maximum radius of the cone of influence for the Hennepin Works injection well is less than one-half mile from the wellbore. Therefore, the AOR for the well extends two miles from the well.

Under 40 CFR § 148.20(a)(2)(ii), a petitioner must locate, identify, and ascertain the condition of all wells within the injection well's AOR that penetrate the injection zone or the confining zone. Hennepin Works conducted a well search over the AOR and found that there are zero wells penetrating the top of the confining zone within this distance. Because there are zero wells that are are improperly plugged, completed, or abandoned, a corrective action plan is not required under 40 CFR § 148.20(a)(2)(iii).

E. Quality Assurance and Quality Control (40 CFR § 148.21(a)) – Hennepin Works has

demonstrated that adequate quality assurance and quality control plans were followed in preparing the petition. Data collected prior to 1988 (before the requirements for the no-migration demonstration were promulgated) were collected in accordance with well-established industry standards, including those for quality control. Procedures for testing carried out since the requirements were promulgated were reviewed and given informal approval as necessary. Hennepin Works followed an appropriate protocol for locating records for penetrations in the AOR, for collection and analyses of geologic and hydrogeologic data, for waste characterization, and for all tasks associated with the modeling demonstration.

III. No-Migration Demonstration

Hennepin Works chose to demonstrate that waste injected at the facility will remain in the injection zone and will not migrate to a point of discharge or interface with an USDW for a period of at least 10,000 years. This demonstration was based on a showing that a geological model representative of the disposal reservoir and the overlying rock strata would contain the waste constituents within the disposal reservoir for a period of at least 10,000 years under the conditions of the simulation.

A. Model Development (40 CFR § 148.21(a)) – A conceptual model was developed using information developed from logs, core, and other testing carried out during drilling and operation of WPL-1. The site-specific information used in the model includes hydrogeologic properties of the various rock layers and formation brines, as well as characteristics of the injected fluid. Where site-specific information was not available or necessary, values from peer-reviewed literature or that have been reported in similar situations were used. Where parameters were uncertain, conservative values were chosen.

Some model parameters are uncertain within a range, yet are critical to the predictions of pressure build-up and waste migration. In accordance with 40 CFR § 148.21(a)(6), a range of values for these parameters was modeled in order to determine the sensitivity of the model to the uncertainties, and to predict the "worst-case scenarios." Sensitivity analyses were conducted using less-conservative input values for specific gravity, permeability, natural velocity of groundwater flow, dispersitivity, porosity, effective dispersion coefficient, and viscosity, among others. This sensitivity testing indicated that the range of uncertainties does not cause significant differences in the predictions of pressure build-up and waste migration, and that input parameters that underestimate the ability of the Injection Zone to contain the waste still lead to acceptable predictions. The use of conservative assumptions and "worst-case scenario" parameters ensures that the no-migration demonstration is conservative.

The predictions of pressurization and the vertical and lateral movement of waste constituents were made using the DuPont suite of subsurface flow and pressure models. The suite includes five different computational routines for predicting the pressure build-up caused by injection, and the lateral and vertical movement of the injected waste. The purpose of the waste transport models is to predict the outer boundary in either the horizontal or vertical direction beyond which no waste will pass during the predicted time period.

B. Model Verification, Calibration, and Validation (40 CFR § 148.21(a)(3)) – The

computer codes used in the DuPont models have been verified by comparing their results with those of analytic and numerical solutions published in literature. The model was calibrated by incorporating historical data from pressure fall-off tests into the representation of the Mt. Simon layer in the DuPont multilayer operational pressure model. The measured average transmissibility indicated by historical pressure fall-off tests is 103,778 millidarcy-feet/centipoise for the entire Mt. Simon Injection Interval. This value, together with values for interval thickness and porosity as determined from geophysical well logs and cores, and model boundary conditions, are inputs to the calibration model. The model is validated by repeated success in reproducing calculated flowing bottom hole pressures.

C. Model Predictions – Two simulated time periods were considered in the demonstration: a 60-year operational period and a 10,000-year post-operational period. The operational period included actual historical injection rates through December 31, 2006, and a projected maximum injection rate of 153 gpm for 22 additional years, through December 31, 2028. The rate history, together with appropriate assumptions and methods of contaminant transport, determined the distance of waste migration in the year 2028, and the maximum pressure build up in the injection zone. The post-operational period was modeled to predict the maximum vertical and horizontal migration of the waste plumes after 10,000 years.

1. Pressure – Maximum pressure buildup, which occurs at the end of the operational period, was predicted by the DuPont Multilayer Pressure Model. The model incorporates 14 rock layers representing stratigraphic units at the well site. The model has conservative assumptions, such as neglecting compressive storage in aquitards, which would reduce pressure in the injection interval. The maximum predicted pressure increase is 88.1 pounds per square inch at the well site, which occurs at the end of the operational period.

2. Vertical Migration – The DuPont Vertical Permeation Short-Term Model predicted the extent of pressure-driven vertical movement during the operational period. The model incorporates 14 rock layers representing stratigraphic units at the well site. Conservative assumptions include a high value for the permeability of the shale caprock, equal density of formation brine and the waste stream, and elevated pressure at the top of the injection interval (as determined by the pressure model described above). The maximum predicted migration distance is less than 0.1 foot into the 207-foot thick Arrestment Interval.

Hennepin Works used the DuPont Vertical Permeation Long-Term Model and the DuPont Molecular Diffusion Model to predict the extent of vertical movement of hazardous constituents during the 10,000-year post-operational period. Both models incorporate 14 rock layers representing stratigraphic units at the well site. A maximum contaminant concentration at the top of the injection interval was assumed. As pressures relax in the post-operational period, vertical permeation is only slightly sensitive to the effects of pressure-driven permeation and anthropogenic activities (accounting for <0.1 feet of permeation). Molecular diffusion overwhelmingly accounts for contaminant transport at this time scale, and the predictions of vertical permeation depend primarily on the effective diffusion coefficients of the contaminants in the represented types of rock formations. With the conservative assumption that diffusion occurs freely in the more permeable layers, the maximum predicted vertical permeation is 148.1 feet above the Mt. Simon Sandstone. Thus, the waste is contained at least 58.9 feet below the

top of the Injection Zone (Figure 1).

Lateral Migration – Lateral migration of the waste plume within the Injection Interval was modeled during both the 60-year operational period and the 10,000 year post-operational period. Several conservative assumptions were used to maximize the size of the waste plume in order to present "worst case scenarios" of plume migration. The edge of the waste plume is defined as the horizontal distance from the wellbore at which the concentrations of both hazardous constituents (chromium and hydrogen ions) are at least 1,000 times less than their maximum concentrations at the well head. At this concentration ratio, the predicted outer edge of the plume meets Health Based Limits even if the concentrations of hazardous constituents in the waste stream were much greater than historical values. In the model, the future injection rate is overestimated at 153 gpm, and the thickness of the Injection Interval was reduced to 114 feet. Dispersion caused by geologic heterogeneities and density differences between injectate and formation brine are incorporated by using a conservative multiplication factor of 13.2, which increases the size of the plume.

Hennepin Works used the DuPont Basic Plume Model to predict the maximum distance of lateral waste plume migration during the operational period. At the end of the projected 60-year operational period, the distance from the center of the plume to the edge (determined at the one part per thousand concentration ratio) is 8024 feet. Therefore, the plume would be less than two miles from the well, which is within the AOR.

The DuPont 10,000-Year Waste Plume Model was used to simulate plume migration during the 10,000 year post-operational period. It considered advection caused by both density drift and the natural groundwater flow within the Mt. Simon Sandstone, as well as hydrodynamic dispersion. Regional hydrogeologic studies of the Mt. Simon Sandstone suggest that the rate of regional flow is less than 0.5 ft/year. A groundwater velocity of 0.415 ft/year was used in the 10,000-Year Waste Plume Model. The specific gravity of the injectate averages 1.2, while that of the formation brine is 1.04. This density difference, along with a formation dip of 75 feet per mile, causes the injectate to "sink" move down-dip as it sinks beneath the formation brine. The dip and the groundwater flow are in the same direction, maximizing their effects on plume migration. Values for longitudinal and transverse dispersivities were calculated using published methods. Advective and dispersive transport causes the outer edge of the plume to migrate approximately 27,800 feet (5.27 miles) from the wellbore. The additional distance due to diffusion is 337 feet, for a total distance of 28,137 feet (5.33 miles). The operational and final plume boundaries are shown in Figure 2.

The nearest point of discharge into a USDW is more than 40 miles away from the facility. Therefore, Hennepin Works has demonstrated that, to a reasonable degree of certainty, hazardous constituents will not migrate vertically out of the injection zone or laterally to a point of discharge in a 10,000 year period.

IV. Conditions of Petition Approval

This proposed reissuance of the land ban exemption for the continued injection of restricted hazardous waste is subject to the following conditions, which are necessary to assure compliance

with the standard in 40 CFR § 148.20(a). Non-compliance with any of these conditions is grounds for termination of the exemption in accordance with 40 CFR § 148.24(a)(1). The facility must petition EPA for approval to change any of the following conditions. Petition modifications and reissuance should be made pursuant to 40 CFR § 148.20 (e) or (f).

1) All regulatory requirements in 40 CFR §§ 148.23 and 148.24 are incorporated by reference;

2) The exemption applies to the existing injection well, WPL-1, located at the Hennepin Works facility at 10726 Steel Drive, Hennepin, Illinois;

3) Injection is limited to that part of the Mt. Simon Sandstone at depths between 3109 and 4800 feet;

4) Only wastes denoted by the waste code K062 may be injected;

5) The chemical properties of the injectate that defined the edge of the plume in the demonstration are limited according to the table below:

Chemical constituent or property	Limitation at the well head
Chromium	Maximum concentration is 1200 mg/L
pH	Minimum pH is zero

6) The monthly average of the specific gravity of the injected waste stream must fall within the range of 1.00 to 1.27;

7) The volume of wastes injected in any month through the well must not exceed 6,705,990 gallons;

8) This exemption is approved for the 22-year modeled injection period, which ends on December 31, 2028. Hennepin Works may petition EPA for a reissuance of the exemption beyond that date, provided that a new and complete petition and no-migration demonstration is received at EPA, Region 5, by July 1, 2028.

9) Hennepin Works shall quarterly submit to EPA a report containing a fluid analysis of the injected waste which shall indicate the chemical and physical properties upon which the no-migration petition was based, including the physical and chemical properties listed in Conditions 5 and 6 of this exemption approval;

10) Hennepin Works shall annually submit to EPA a report containing the results of a bottom hole pressure survey (fall-off test) performed on WPL-1. The survey shall be performed after shutting in the well for a period of time sufficient to allow the pressure in the injection interval to reach equilibrium, in accordance with 40 CFR §146.68(e)(1). The annual report shall include a comparison of reservoir parameters determined from the fall-off test with parameters used in the approved no-migration petition;

11) The petitioner shall fully comply with all requirements set forth in Underground Injection Control Permit UIC-004-W1-JL issued by the Illinois Environmental Protection Agency; and

12) Whenever EPA determines that the basis for approval of a petition may no longer be valid, EPA may terminate this exemption and will require a new demonstration in accordance with 148.20.

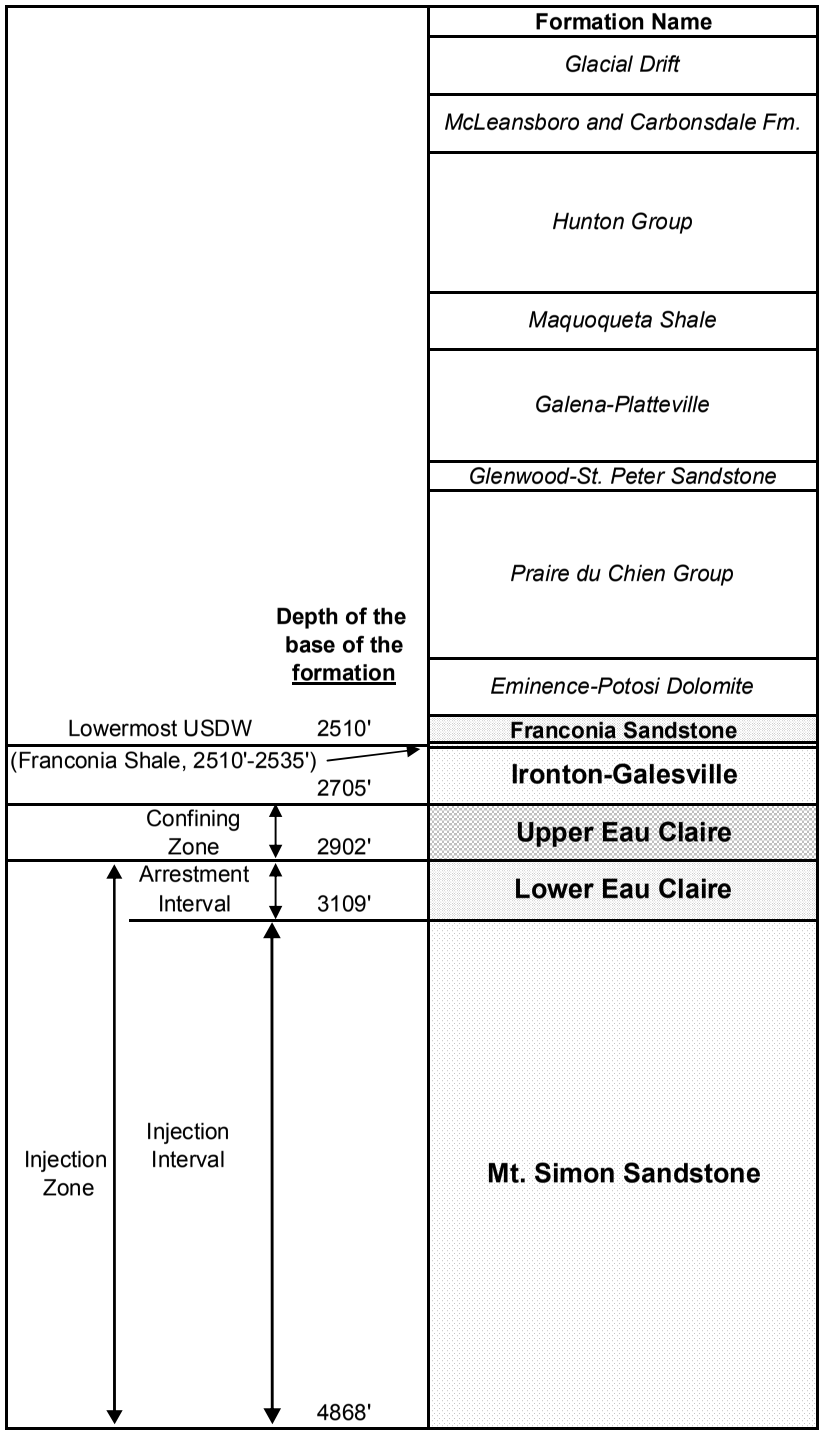
Date: The EPA, Region 5, Chicago office, requests public comments on today's proposed decision. Comments will be accepted until December 26, 2008. Comments postmarked after the close of the comment period will be stamped **"Late"**. Late comments do not have standing and will not be considered in the decision process. To request an informational meeting or a public hearing on this proposal, submit your request in writing on or before December 26, 2008 stating the issues to be raised.

Addresses: Submit written comments and hearing requests by mail to:

Rebecca L Harvey, UIC Branch Chief
United States Environmental Protection Agency, Region 5,
Underground Injection Control Branch (WU-16J)
77 West Jackson Boulevard
Chicago, Illinois 60604-3590

Comments may be submitted by email to harvey.rebecca@epa.gov.

For Further Information: Contact Leslie Patterson, Lead Petition Reviewer, at the above address, by telephone at (312) 886-4904, or by email at patterson.leslie@epa.gov.



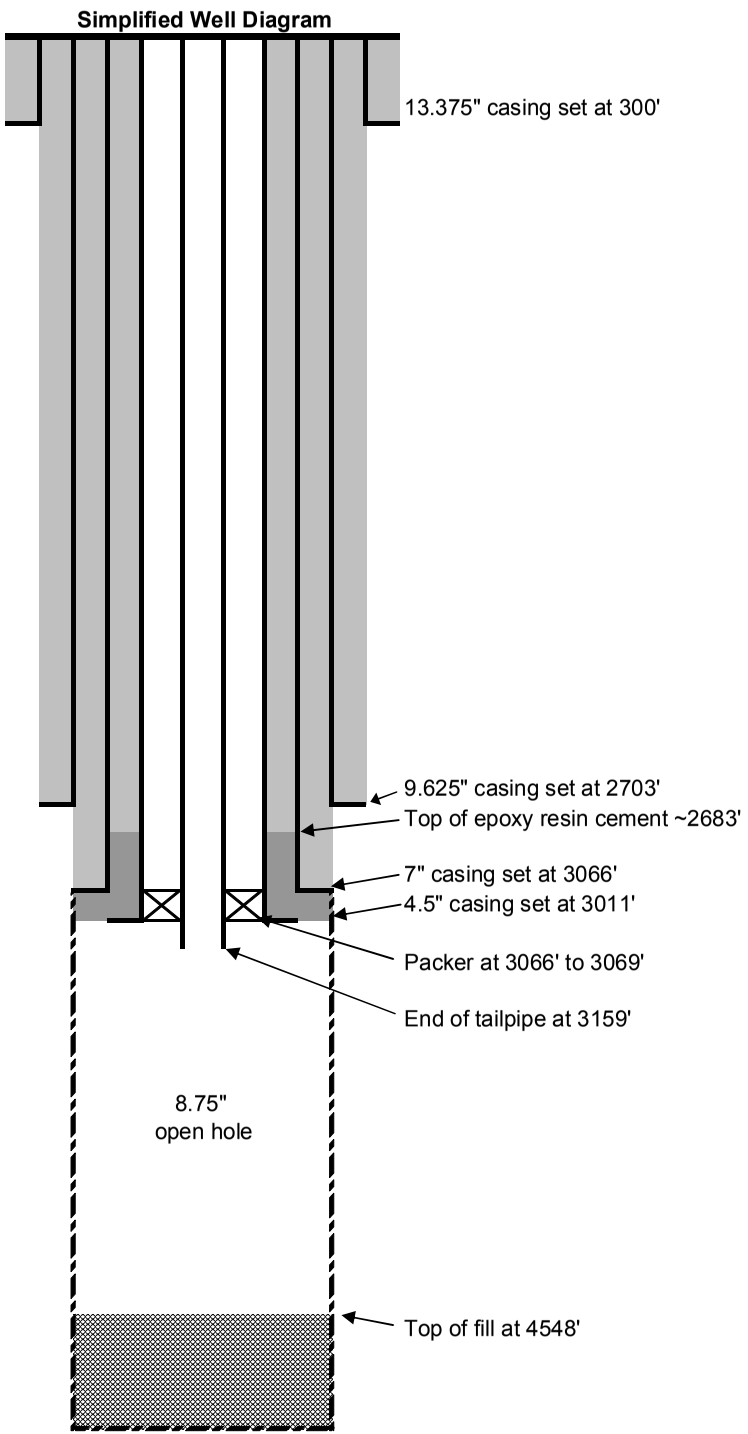


Figure 1: Formation Depths and Simplified Well Diagram

Figure 2: Operational and 10,000-year Plume track, Hennepin Works WPL-1